Evaluation of the Clay Layer and Tar Surface Elevation in Impoundment 2

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DATE: December 6, 2013

540475

This memorandum summarizes the Impoundment 2 clay and tar investigation activities that were completed in October 2013 in support of the pilot study at Operable Unit (OU) 8 of the American Cyanamid Superfund Site in Bridgewater, New Jersey, which include the following:

- Evaluating the depth and thickness of clay and silt beneath impoundment 2 within the area of the OU8 pilot test.
- Mapping the acid tar surface elevation in the northwestern portion of Impoundment 2 where the OU8 pilot study will be conducted
- Evaluating the distribution of tar within the OU8 pilot test area

The pilot study is described briefly below and additional details are found in the *100 Percent Design of Pilot Study for Operable Unit 8, American Cyanamid Superfund Site* (CH2M HILL 2013).

The primary objectives of the investigation prior to caissons installation was to locate the elevation of the top of clay, determine the thickness of clay, and map the elevation of top of tar at the locations where the caissons were to be installed. To the extent practical (due to limitations discussed in this memo related to poor recovery) logging of the types of tar material were performed also. After caisson installation, additional investigative efforts were performed to determine the type of tar material within each caisson. The results of the additional investigative efforts are documented in a separate memo to the USEPA.

The tar assessment investigation objectives are as follows:

- Verify the presence of and determine the elevation and thickness of the clay layer beneath each caisson location for the pilot study.
- Determine the lengths of the caissons and heater cans for the pilot study.
- Determine the elevation of the water cap to be maintained during the pilot study.
- Determine the elevation of the surface of the acid tar in the northwestern portion of Impoundment 2.
- Determine the distribution of viscous rubbery (VR) and hard crumbly (HC) tar within each caisson location.
- Evaluate the rate of water infiltration into the drilling casing set into the materials beneath the acid tar.
- Collect additional impoundment material from caisson location #1 to be used in a final treatability study to adjust the recipe for the in-situ solidification/stabilization (ISS).

Methods

The following section describes procedures used during execution of the pilot study tar assessment.

Tar Surface Mapping

The surface of the acid tar in Impoundment 2 was mapped on September 25, 2013 by Vargo Associates of Clifton, New Jersey (Vargo). The elevation was surveyed using the North American Vertical Datum 1988 (NAVD88). To locate the surface of the tar, a survey team was deployed to the top of Impoundment 2 in a boat. At each station, a survey rod was pushed through the water cap to the top of the synthetic cover above the tar. The top of tar at each station was located by pushing down on the top of the synthetic cover above the acid tar to displace water that may be trapped underneath the cover above the acid tar surface.

Impoundment 2 Borings

Information regarding the elevation of the top of the clay and thickness of the clay reported beneath Impoundment 2 is found in *Source Assessment and Remedy Program Lagoons 1 and 2* (OBG 1982). However, additional data regarding the depth and thickness of the clay layer beneath Impoundment 2 were required to complete the design of the caissons for the pilot study.

Tar and Clay Assessment

To conduct the assessment, a direct push technology (DPT) drill rig was deployed on top of the Flexifloat platform to complete borings through the acid tar materials at each of the three caisson locations. The location of each caisson location on the Flexifloat platform is depicted on Figure 1. One boring was completed at each caisson location from October 14 through 17, 2013. Two additional borings were completed at caisson locations #1 and #2 and three additional borings were complete at the caisson location #3 from October 22 through 24, 2013. The location of each boring completed is depicted on Figure 2. Prior to initiation of drilling, the synthetic cover was cut so that it did not interfere with core collection of the impoundment materials.

Prior to drilling at each caisson location, the depth of the tar was probed using a 1.5-inch diameter steel rod. The rod was advanced through the acid tar by hand until refusal was encountered. The depth of the first core in each caisson was based on the results of the probing.

The DPT drill rig was outfitted with a dual tube sampling system consisting of a 5-foot outer tube with a 2.25-inch (outer diameter) steel core barrel and a 5-foot long inner tube with a 1.125-inch (inner diameter) steel core barrel lined with a disposable acetate liner, which was utilized to collect materials from each caisson location. During sample collection, both core barrels were advanced into the acid tar at the same time. When the inner core barrel was advanced to the desired depth, it was recovered, the core removed for logging, and a new acetate liner installed. Then both core barrels were advanced to the next interval. The dual tube method allowed for the elimination of sloughing as well as effectively sealing the probe hole when drilling through water.

After probing through the base of the acid tar at each caisson location, the infiltration rate of water into the outer core barrel was evaluated by measuring the change in water level within the outer core barrel of the dual core system. The information from the cores was used to determine when base of the core barrel was set beneath the acid tar. Then the elevation of the water inside the outer core barrel was measured using a water level meter. After approximately 1-hour the water level in the rods was measured again to determine the change over time.

After reaching the bottom of the impoundment at each boring location, the elevation of the top of the direct push core barrel was surveyed into the NAVD88 datum by Vargo. After completion of each boring, the boreholes were sealed with Portland cement placed into the boring through the outer core barrel of the dual tube sampler via bottom-up pressure grouting.

Core Processing

The cores containing the impoundment materials were cut open along the length of the core to expose the contents. Each core was screened using a photoionization detector (PID), and sulfur dioxide (SO_2) meter, photographed, and logged using the Unified Soil Classification System (USCS) classification system to document the extent of different classes of impoundment materials present.

Material Collection for Final Solidification/Stabilization Testing

Acid tar from caisson location #1 was collected and shipped to Remedial Construction Corp. (RECON) of Houston, Texas to complete subsequent in-situ solidification/stabilization (ISS) testing. This material was collected by using the direct push rig to advance a 4-inch diameter polyvinyl chloride (PVC) pipe into the acid tar material. Upon recovery, the pipe was cut open lengthwise and a mixture of HC, VR and VR/HC Mixed tar was placed into 5-gallon polyethylene buckets lined with Teflon. The Teflon liners were sealed using zip ties so that minimal headspace remained in the bag after sealing. The filled containers (total 4 containers) of tar were shipped to RECON via Federal Express under a hazardous material manifest.

Results

The results of the assessment are described below. Because the caissons are being supported by the floating platform during the pilot study, the data obtained during this study were used to establish the elevation at which the water cap on Impoundment 2 will be maintained during the pilot test and to determine the length of each caisson for the pilot study.

Top of Tar Surface Mapping

A contour map depicting the elevation of the acid tar is depicted as Figure 3. A total of 158 stations were surveyed to map the tar/water interface of Impoundment 2 in the area of the pilot study. Approximately 25 percent of the Impoundment 2 area was surveyed. A small amount of tar (less than 6 inches) was noted on top of the synthetic cover at 26 locations. These locations were not used to determine the elevation of the tar/water interface.

Infiltration Assessment

The infiltration assessment was completed to provide an estimate of the potential for water from the water cap to travel down the sides of the caissons and/or enter the caissons through the bottom. If large amounts of water enter the caissons during the pilot study, achieving the desired temperature during the thermal treatment may be difficult. The data from this evaluation is located in Table 1.

TABLE 1
Water infiltration Data
Pilot Study Clay and Tar Evaluation

Boring Number	Initial Water Depth in Rods (Feet)	Final Water Depth in Rods (Feet)	Material at Base of Rods	Test Time (Minutes)
Caisson 1	20.03	20.03	Clay with Silt and Trace Fine Sand	60
Caisson 2	7.84	7.85	Clay with Silt and Trace Fine Sand	75
Caisson 3	19.07	19.07	Clay with Silt and Trace Fine Sand	45

The casing contained no water during the completion of the borings at caisson locations #1 and #3. Water entered the casing during completion of the boring for caisson #2. It is suspected that water entered the casing at caisson location #2 through the joints in the casing rather than through infiltration from the base of the boring. During completion of the remaining borings during the assessment, the casing joints were sealed with Teflon tape and subsequent borings completed at the caisson #2 location did not flood. The infiltration data indicate that water did not enter the casing at caisson locations #1 and #3.

Clay and Tar Assessment

As indicated above, the cores collected from each caisson location during the assessment were logged to determine the distribution of acid tar materials and presence and thickness of the clay layer (Attachment 1). The

coring logs from each boring are located in Attachment 1 to this memorandum. Recovery of acid tar materials was generally poor. Observations from the core logs indicate the following factors that contributed to poor recovery of the acid tar materials:

- It was likely difficult to shear the soft VR tar with the core barrel as it moved through the VR tar and the tar moved around the outside of the core barrel.
- The VR/HC mixed tar was generally very loose and when recovered, compressed inside the core barrel, apparently reducing the recovery. Similar to the VR, the VR/HC mixed tar was likely difficult to shear and core barrel often moved through this material without recovery.
- The HC tar also tended to compress. This material tended to be more firm and would clog within the core barrel which prevented additional full cores from being collected.

Figure 4 depicts the boring logs at each caisson location.

The information obtained regarding the materials below the acid tar is accurate. Once these materials were first encountered in the cores from each caisson location, the elevation of the drilling casing was surveyed. After the survey, additional material was collected, confirming the type and depth of material in the previously collected core.

The data from the core logs indicate significant variability in the distribution of VR and HC tar within each caisson location. In addition, there is significant variability in the elevation of the bottom of the impoundment at each caisson location. Each core log is graphically represented in Figure 4. A description of the different materials identified in the core logs is provided below:

- HC: This material was identified in each boring completed. The composition of the HC tar was variable and ranged from soft, fibrous and wet to firm, granular and dry. Clear to white crystals were noted in some of the HC material. The HC tar material was black and high VOCs were identified using a PID. The HC tar was often fractured and the HC tar in the fracture zone was moist to wet.
- VR: This material was identified in 5 of the 11 borings completed during the investigation. The VR tar was black, soft, tar that somewhat flowed when the core liner was cut open. A skin formed on the surface of the tar over time. The VR tar had a strong odor. While VR material was only identified in 5 of the 11 borings completed, it is believed that areas when no recovery was seen (which occurred in all 11 borings) are an indication of either VR or MIX.
- VR/HC mix (MIX): This was identified in 3 of the 11 boring completed and is soft, loose tar globules, coated with VR tar. As stated above, MIX was only identified in 3 of the 11 borings completed, it is believed that areas when no recovery was seen (which occurred in all 11 borings) are an indication of either VR or MIX. Additional investigation activities performed after installation of the caissons (as documented to USEPA in a separate memo dated November 26, 2013), it is believed that the areas of no recovery are either VR or MIX, which varied at each boring location.
- Silt with Clay, Trace Sand and/or Gravel (ML): This material was identified in 5 of the 11 borings and is dominated by clay and silt with the percentages varying. Fine sand was also noted in this unit at up to about 30 percent. This material ranged from wet to dry depending on the particle size and density and is likely the clay and silt material placed in the base of the impoundments described in the previous reports.
- Silty Sand with Trace Clay (SM): This unit was identified in 4 of the 11 borings completed. This unit was dominated by silt sized particles and contained various amounts of fine sand and clay. Gravel was also sporadically noted in this unit.
- Poorly Graded Sand with Silt and Gravel (SP/SM): These materials were identified in the caisson #2 area only. This unit consists of non-plastic fine sand with varying amounts of silt and gravel.
- Clay (CL): This material was identified in only one boring at caisson #3 location. The clay was moist, fat, plastic, homogeneous, firm to stiff.

- Transition Zone (TZ): This material was identified in 3 or the 11 borings. It was not seen in caisson #1 location. The Transition Zone contains loose mix of sand, silt and clay impacted with tar.

As noted in Figure 4, at each caisson location, borings were completed that did not contain clay material. Therefore, portions of each caisson location are missing the clay layer reported in the impoundment construction drawings.

Conclusions

While the data from the core logs varied significantly, each caisson was determined to contain HC tar, VR tar, and VR/HC mix (MIX). The data collected during this evaluation was used to determine the elevation of the base of the caissons during execution of the pilot study. The final elevation of the base of the caissons is dependent upon the cut length of each caisson and the elevation of the water cap in Impoundment 2. Final cut length of each caisson and the elevation of the bottom of each caisson are found in Table 2. The water elevation of impoundment 2 will be set at 35.5 feet NAVD88. This will allow the base of each caisson to sit as depicted in Figure 4. The final bottom elevation of each caisson was selected so as to obtain some seal into the clay, where this was possible, but without puncturing the clay layer with the caissons.

TABLE 2
Caisson Installation Data
Pilot Study Clay and Tar Evaluation

Caisson Number	Cut Length (Feet)	Bottom Elevation[1] (Feet)
1	15.41	23.62
2	15.90	23.13
3	15.60	23.43

[1] Elevations in NAVD88

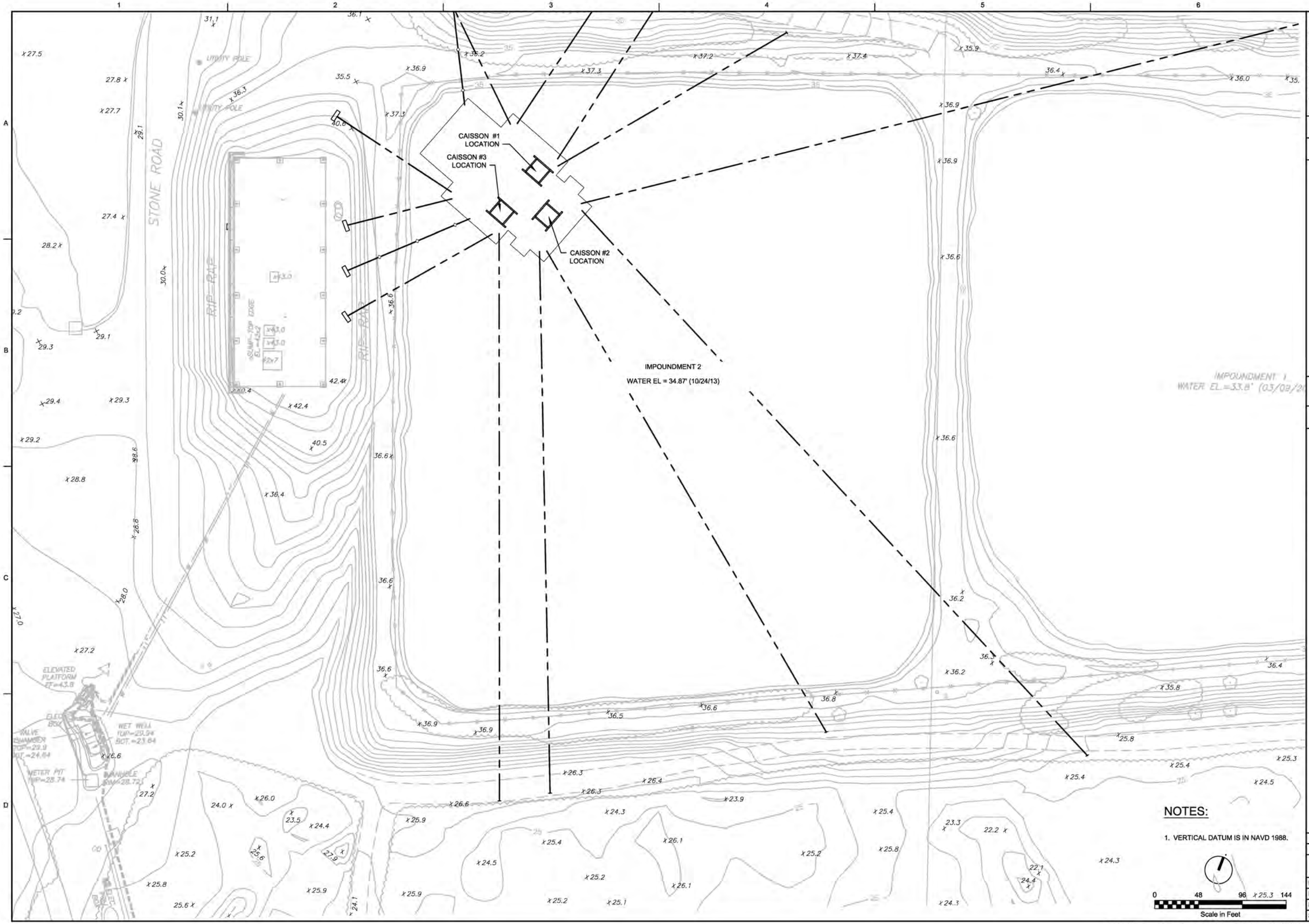
References

CH2M HILL 2013. 100 *Percent Design of Pilot Study for Operable Unit 8, American Cyanamid Superfund Site*. September.

O'Brien and Gere 1982. *Source Assessment and Remedy Program Lagoons 1 and 2.* December.

O'Brien and Gere 2010. *Impoundments 1 and 2 Characterization Program Summary Report.* November 16.

Figures



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IMPOUNDMENTS 1 AND 2
PILOT DEMONSTRATION STUDY
WYETH HOLDINGS CORPORATION
AMERICAN CYANAMID SUPERFUND SITE
401 CROWLEY DRIVE
BRIDGEWATER, NJ

CH2MHILL

CIVIL
FLEXIFLOAT LAYOUT

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	2013/11/05
PROJ	472109
DWG	Figure 1
SHEET	

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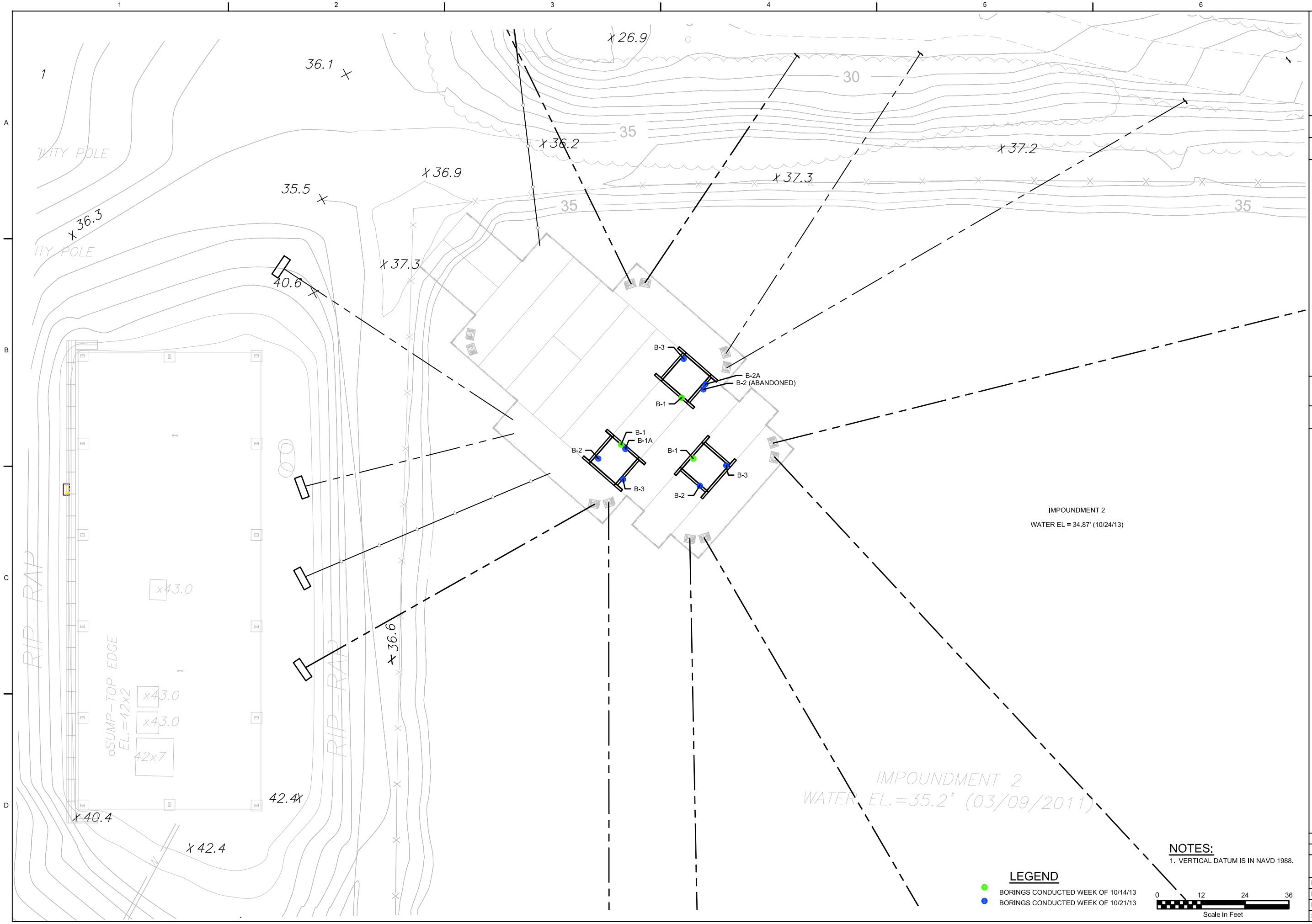

NOTES:

1. VERTICAL DATUM IS IN NAVD 1988.

LEGEND

- BORINGS CONDUCTED WEEK OF 10/14/13
- BORINGS CONDUCTED WEEK OF 10/21/13

0 12 24 36

Scale in Feet

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BRIDGEWATER, NJ

CH2MHILL

CIVIL

IMPOUNDMENT 2
CAISSON BORING LOCATIONS

VERIFY SCALE

BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	2013/11/05
PROJ	472109
DWG	Figure 2
SHEET	

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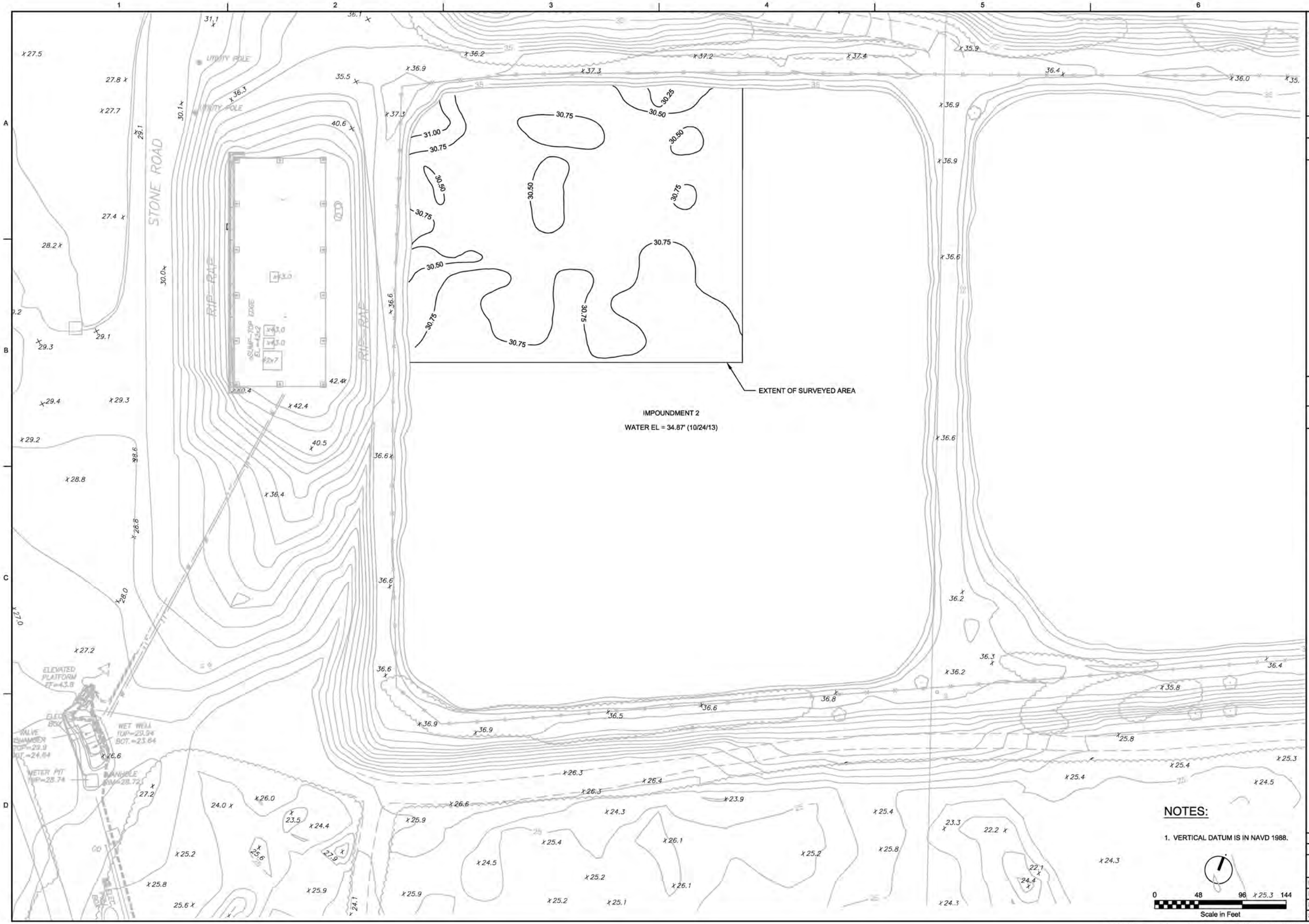

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IMPOUNDMENTS 1 AND 2
PILOT DEMONSTRATION STUDY
WYETH HOLDINGS CORPORATION
AMERICAN CYANAMID SUPERFUND SITE
ROCKAWAY AVENUE
BRIDGEWATER, NJ

CIVIL
IMPOUNDMENT 2
ACID TAR SURFACE ELEVATION

VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	2013/11/05
PROJ	472109
DWG	Figure 3
SHEET	

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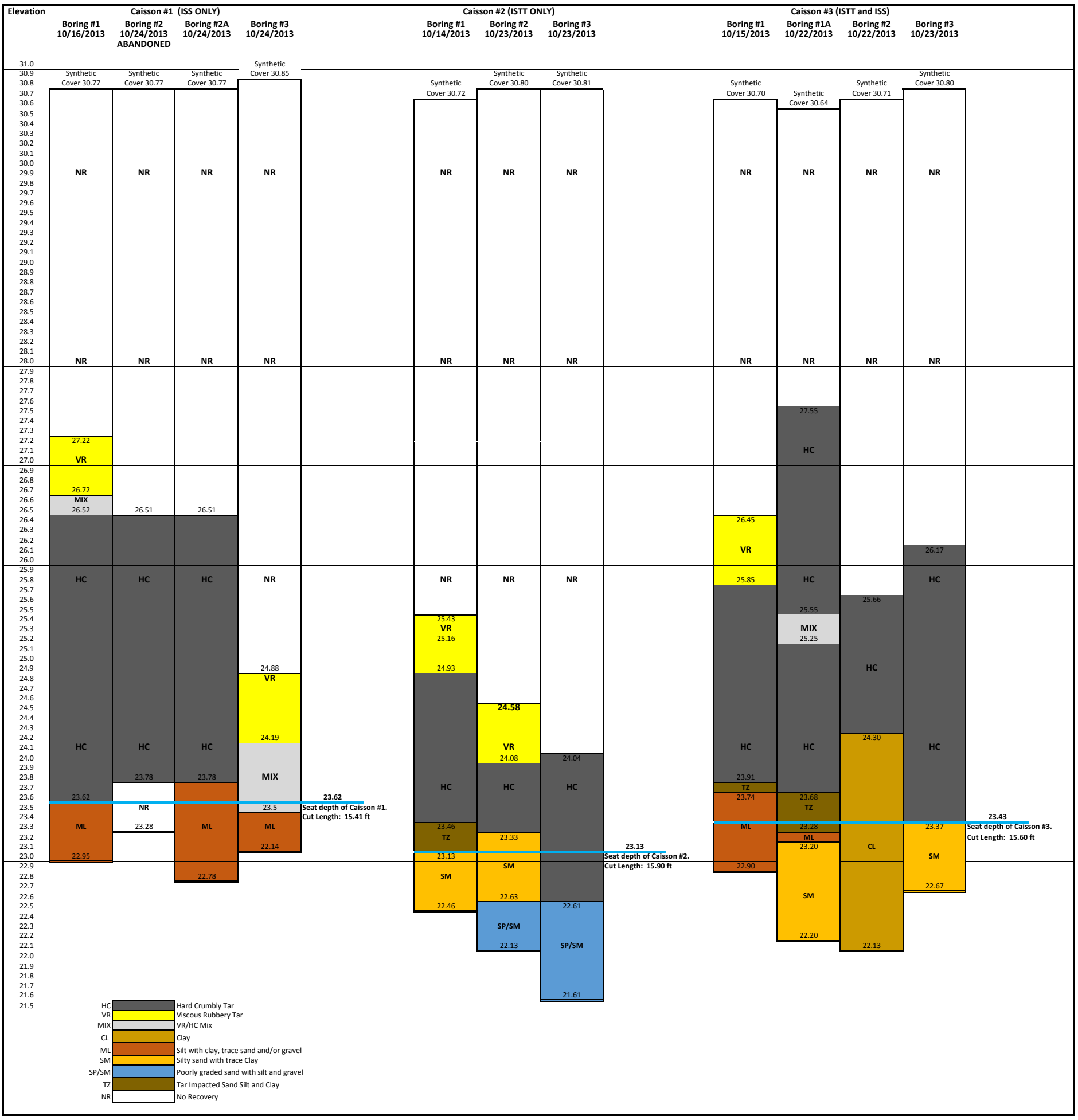
FIGURE 4

Impoundment 2 Boring Core Log Summary

OU Pilot Study Clay and Tar Evaluation



Attachment 1

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CAISSON #1, Boring 4 | Easting: | Attempt 1 | Refusal? Y/N
Sampling: M.Velasquez; I.Zmudzin | Northing: | Penetration (ft): 5.6 | N
Crew/Company: REMCON | Elevation: -- | Recovery (ft): multiple
K. Fletcher | Datum: | Date/Time: 8/13/13
P. Cellitti | Depth (ft):
St. Arrival: 1400 | Attempt 2 | Refusal? Y/N
Vessel: Flexifloat Platform | St.Depart: 1500 | Penetration (ft):
Collection: Direct-push Geoprobe | Logged by: M. Velasquez | Recovery (ft):
Collector Information: | Date/Time:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
				NO RECOVERY											SO2
2.4		VR	10 YR 2/1	VS	M	H	Wet	Z	T	0%	0%	100%	13.2		0.0
3.3		IN		S	W			VFS			5%	95%	28.4		0.7
3.9		HC		M	N		Dry	FS			5%	95%	38.9		19.8
4.6				F			Moist	MS			10%	90%	45.1		
													40.9		14.9
5.6				B	0.C	C	5.6	below	tar				22.6		24.9

Run	Penetration	Recovery
1	4.6	1.7'
2	5.6	1.0'

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B	NA	NA	NA	NA		NA						
C												
D												
E												

Reviewed by: Date:

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CAISSON #1 Boring 4A
Sampling: M.Velasquez; I.Zmudzin
Crew/Company: REMCON
K. Fletcher
P. Lellouft
Vessel: Flexifloat Platform
Collection: 4" PVC Casing
Collector Information:

Easting:
Northing:
Elevation: --
Datum:
Depth (ft):
St. Arrival: 1300
St.Depart: 1600
Logged by: M. Velasquez

Attempt 1 — Refusal? Y/N: N
Penetration (ft): 5.0
Recovery (ft): 3.4
Date/Time: 11/13/13

Attempt 2 — Refusal? Y/N:
Penetration (ft):
Recovery (ft):
Date/Time:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
				NO RECOVERY											
1.6		VR	10 YR 2/1	VS	M	H	Wet	F	T	0%	0%	100%	958		SO2
													300		0.0
2.5		IN		S	W			VFS			2%	98%			
													965		0.0
2.7		HC		H	N		Dry	FS			5%	95%	999		0.4
													999		2.1
5.0													473		150
				B.O.C = 5.0' below bar											

* Advanced 4-inch PVC pipe at this location to approximately 5.0 ft below bar. Installed w/ weight of hammer.

Run	Pen.	Rec.
1	5.0	3.4

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B	NA	NA	NA	NA		NA						
C												
D												
E												

Reviewed by: Date:

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CAISSON #2 Boring 4A
Sampling: M.Velasquez; I.Zmudzin
Crew/Company: REMCON
K. Fletcher
P. Celotti
Vessel: Flexiflex platform
Collection: Direct-push Geoprobe

Easting:
Northing:
Elevation: --
Datum:
Depth (ft):
St. Arrival: 0857
St.Depart: 1000
Logged by: M. velasquez

Attempt 1 — Penetration (ft): 7.4' — Refusal? Y/N: N
Recovery (ft): multiple
Date/Time: 11/13/13

Attempt 2 — Penetration (ft):
Recovery (ft):
Date/Time:

Collector Information:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
				NO	RECOVERY										SD2
4.2		HC	10YR 2/1	F	N	H	Dry	FS	T	0%	2%	98%	7.7		0.2
4.4				NO	RECOVERY										NA
6.93		HC	10YR 2/1	H	N	H	Dry	MS	T	0%	2%	98%	8.1		0.1
7.40					BJ.C	C	7.4'	below	ter						

* Boring 4 - push core to 20' feet below ter.
IN → ~~1.6-1.8'~~ 1.6'-1.9'
HC → 1.8-20'

Run	Pene.	Rec.
1	4.4	0.2
2	7.4	0.5

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B												
C	NA	NA	NA	NA								
D												
E												

Reviewed by: Date:

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CAISSON #2, Boring #B
Sampling: M.Velasquez; I.Zmudzin
Crew/Company: REMCON
K. Fletcher
P. Lelliott
Vessel: Flexiflot platform
Collection: Direct-push Geoprobe
Collector Information:

Easting:
Northing:
Elevation: --
Datum:
Depth (ft):
St. Arrival: 1000
St.Depart: 1030
Logged by: M. Velasquez

Attempt 1 — Refusal? Y/N
Penetration (ft): 7.4
Recovery (ft): ~~4~~ (multiple)
Date/Time: 12/13/13

Attempt 2 — Refusal? Y/N
Penetration (ft):
Recovery (ft)
Date/Time:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
			NO		RECOVERY										SO_2
2.8		FN ↓ HC	10YR 2/1	S ↓ F	W ↓ N	H	Wet ↓ Dg	VFS	T	0%	~~58.~~ 29.	98%	19.1		0.3
3.0													132		3.6
4.0													695		13.6
4.4															—
			NO		RECOVERY										NA
7.1		HC	10YR 2/1	H	N	H	Dg	VFS	T	0%	24%	85%	2214		—
7.4															1.2
						B.UC	C	7.4	below	tar					—

Advanced 1" inside casing w/ geoprobe w/o core catcher

Run	Ave	Rec
1	4.4'	1.6'
2	7.4'	0.3'

* measurement to top of tar from inner caisson = 7.57

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B	NA	NA	NA	NA		NA						
C												
D												
E												

Reviewed by: Date:

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CAISSON # 2, BORING 4C
Sampling: M.Velasquez; I.Zmudzin
Crew/Company: REMCON
K. Fletcher
P. Celliott
Vessel: Flexfloat platform
Collection: 4" PVC casing

Easting:
Northing:
Elevation: –
Datum:
Depth (ft):
St. Arrival: 1040
St.Depart: 1230
Logged by: M. Velasquez

Attempt 1 — Refusal? Y/N: Y
Penetration (ft): 5.0'
Recovery (ft): 2.4
Date/Time: 11/13/13

Attempt 2 — Refusal? Y/N:
Penetration (ft):
Recovery (ft):
Date/Time:

Collector Information:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
				NO		RECOVERY									SD2
2.0		HC	N4/2 2/1	F	W	H	Wet	VFS	T	0%	2%	98%	50.0		1.9
		↓		↓	↓			↓			↓	↓	673		33.7
3.2		IN		S	M			Z			0%	100%	1967		4.2
		↓		↓	↓			↓			↓	↓			
3.5		HC		H	N		Dry	VFS			27.	98%	1587		150
		↓		↓	↓		↓	↓			↓	↓	1676		13.0
4.4					B.S.C		@	4.4		below	bar				

* Refusal due to loss of pipe encountered @ 4.4' below bar.

Run	Pen	Rec
1	5.0	2.4
	Refusal @ 4.4'	

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B												
C	NA	NA	NA	NA		NA						
D												
E												

Reviewed by: Date:

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CA1350N#3 Boring 4
Sampling: M.Velasquez; I.~~Zmudzin~~ S Maxwell
Crew/Company: REMCON
K Fletcher
P. Velliotf
Vessel: Flexifloat Platform
Collection: Direct Push Geoprobe
Collector Information:

Easting:
Northing:
Elevation: --
Datum:
Depth (ft):
St. Arrival: 1000
St.Depart: 1215
Logged by: M.Velasquez

Attempt 1 — Refusal? Y/N: N
Penetration (ft): 3.5'
Recovery (ft) 1.0'
Date/Time: 11/12/13 @ 1000

Attempt 2 — Refusal? Y/N:
Penetration (ft):
Recovery (ft)
Date/Time:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
				NO RECOVERY											
2.5		IN	10YR 2/1	S	M	H	Wet	Z	T	0%	0%	100%	20	N	SO_2 0.0
3.0		HC		F	N	H	Dry	VFS	T	0%	2%	98%	19.6	S A M P L E	0.0
3.5													14.4		
				B.O.C = 3.5' below top of tc											

* Attempt 2 logged white crystals observed in HC material

Attempt 1

Run	Pen	Recovery
1	1.5'	0.2'
replicate		

Attempt 2

Run	Pen	Recov
1	1.5'	.5
2	3.5	.5
replicate		

Attempt 3

Run	Pen	Recov
1	4.0'	0.0'
replicate		

Attempt 4

Run	Pen	Recov
1	5.0'	1.3'

3.5 - 4.8 - mix intermediate material (IN) encountered @ Attempt 4

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B	NA	NA	NA	NA		NA						
C												
D												
E												

Reviewed by: Date:

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CAISSON #3 Boring 4A
Sampling: M.Velasquez; ~~I.Zmudzin~~ S Maxwell
Crew/Company: REMCON
K. Fletcher
P. Lelliott
Vessel: Flexifloat Platform
Collection: ~~Direct push Geoprobe~~ (4" PVC pipe)
Collector Information:

Easting:
Northing:
Elevation: –
Datum:
Depth (ft):
St. Arrival: 1400
St.Depart: 1610
Logged by: M. Velasquez

Attempt 1 — Refusal? Y/N: ~~Y~~ N
Penetration (ft): 5.7
Recovery (ft) 2.2
Date/Time: 11/12/13 @ 1400

Attempt 2 — Refusal? Y/N:
Penetration (ft):
Recovery (ft)
Date/Time:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
		NO RECOVERY													SO_2
3.5		VR	10YR 2/1	S	M	H	Wet	Z	T	0%	0%	100%	234	N	0.3
													36.2	O	
4.6		IN		F	W		Dry	VFS		0%	2%	98%	10.7		3.5
													144	S	
5.2		HC		H	N		Dm	VFS		0%	5%	95%	261	A	6.6
													606	M	
5.7													1056	P	
													721	L	
		Bottom of core = 5.7 below top of tar												E	

* Advanced 4-inch PVC pipe at this location, to approximately 5.9' below tar top; installed w/ weight of hammer.

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B												
C	NA	NA	NA	NA		NA						
D												
E												

Reviewed by: Date:

CH2MHILL

Site Name: American Cyanamid Superfund Site
Project Number: 473605.01.IN
Project Location: Bridgewater, NJ
Survey Duration:

Station ID: CAISSON #3 Borehole
Sampling: M.Velasquez; I.Zmudzin 4B
Crew/Company: REMCON
K. Fletcher
P. Walloff
Vessel: Flexifloat Platform
Collection: Direct-push Geoprobe
Collector Information:

Easting:
Northing:
Elevation: --
Datum:
Depth (ft):
St. Arrival: 0830
St.Depart: 0915
Logged by: M.Velasquez

Attempt 1 — Refusal? Y/N
Penetration (ft): 6.0' — N
Recovery (ft) 1.0'
Date/Time: 11/13/13 0830

Attempt 2 — Refusal? Y/N
Penetration (ft):
Recovery (ft)
Date/Time:

Log reflects sample as collected- no correction factor applied for less than 100% core recovery

Depth below mudline (ft)	Lithology	Type	Color (Munsell)	Consistency/ Density	Cementation/ Plasticity	Structure	Moisture Content	Maximum particle size*	Odor	% gravel	% sand	% fines	PID Reading (ppm)	Sample IDs (Single Letter)	Comments
		NO RECOVERY									5%	95%			
5.0		IN	10YR 2/1	S	M	H	wet	FS	T	0%	~~5%~~	~~100%~~	39.9		0.0
													13.5		0.2
5.8	*	HC	10YR 2/1	H	N	H	Dry	FS	T	0%	5%	95%	7.9		0.0
6.0															
		B.O.C = 6.0' below top of tar													

* white crystals observed in HC material

Run	Pen.	Recovery
1	6.0'	1.0'

*Maximum particle size not provided in log.
CA Coal Aggregate material
HC Hard-crumbly material
VR Viscous-rubbery material

Sample Summary (check boxes for analysis):

		Sample Type (N/FD/MSD)	Sample Date/Time	Depth Interval (ft)	Thermal	Stabilization & Solidification						
A												
B	NA	NA	NA	NA								
C												
D												
E												

Reviewed by: Date: